Proceedings of the Iowa Academy of Science

Volume 35 | Annual Issue Article 11

1928

Tests on Soilvita

L. W. Erdman
Iowa State College

P. E. Brown
Iowa State College

TESTS ON SOILVITA

L. W. ERDMAN AND P. E. BROWN

Soilvita (soil life) is a preparation on the market for the inoculation of all crops. It is claimed that this culture "grows better and larger crops of all grains, vegetables, beautiful lawns and luxuriant flowers." The culture is supposed to contain all desirable soil organisms except the legume bacteria and the introduction of these organisms into the soil is supposed to bring about a great stimulation in the production of available plant food and hence in the yields of all crops.

The material is put up in a liquid form and is claimed to be "ready at any time for use on any part of the farm or garden." It is put out by the Soilvita Distributing Company of Fargo, North Dakota, and has been sold extensively in that state, in Kansas, Minnesota, Illinois, Montana, Iowa and Canada and perhaps elsewhere. Many testimonials from farmers and others in these states have reported large effects from the use of the Soilvita.

It has seemed desirable to study the culture bacteriologically in order to determine the reasons for its value, if it has any, and to ascertain whether or not the claims made for it are warranted.

EXPERIMENTAL

To determine the presence and activity of some of the essential soil organisms, tests were made of the ammonifying power, the nitrifying power, the nitrogen-fixing power and the total numbers of microörganisms in the Soilvita.

Ammonification in Peptone Solutions — A one per cent peptone solution was made up with tap water and 100 c.c. portions were sterilized in 500 c. c. Erlenmeyer flasks. Three flasks were inoculated with 5 c. c. of Soilvita; three were inoculated with 5 gms. of Carrington loam; and three received 5 c. c. of Soilvita and 5 grams of Carrington loam. These cultures were incubated at room temperature for four days. Ammonia was then determined by distillation with magnesium oxide into standard acid. The results of this study are given in table I.

(Contribution from the Laboratory of Soil Chemistry and Bacteriology, Iowa State College.)

The average amount of ammonia nitrogen produced in the three cultures treated with 5 c. c. of Soilvita was almost identical with that produced in the cultures inoculated with 5 gms. of Carrington loam. Where the peptone solution was inoculated with both Soilvita and Carrington loam, the amount of ammonia formed was greater by about 11 mgs. This might be expected as greater numbers of ammonifying organisms were added in these cultures and consequently more ammonia was produced in the same period of time. The increase, however, was relatively small and shows very little effect from the Soilvita on the ammonifying power of the soil.

Table I — Comparative Effect of Carrington Loam and Soilvita on the Ammonification of Peptone in Solution

Lab. No.	Treatment	Nitrogen Mgs.	Average Nitrogen Mgs.
1	Soilvita — 5 c. c.	87.9	
2	Soilvita — 5 c. c.	82.8	85.9
3	Soilvita — 5 c. c.	86.9	
4	Carrington loam — 5 gms.	85.3	
5	Carrington loam — 5 gms.	84.4	85.0
6	Carrington loam — 5 gms.	85.4	
7	Soilvita — 5 c. c. + Carrington loam – 5 gms.	96.9	
8	Soilvita — 5 c. c. + Carrington loam – 5 gms.	97.1	96.6
9	Soilvita — 5 c. c. + Carrington loam – 5 gms.	96.0	

Ammonification in Soil — For this study nine 116.2 gram portions of fresh Carrington loam (this amount being equivalent to 100 grams of moisture-free soil) were weighed into tumblers and treated as follows: three were used as checks, the only treatment being the addition of sterile water to bring the soil up to the optimum moisture content; three received one gram of dried blood; and to the remaining three were added one gram of dried blood and 5 c. c. of Soilvita. After adjusting the moisture in the soils to the optimum, the tumblers were incubated at room temperature for one week. Ammonia was determined in these cultures by extraction with a 10 per cent NaCl solution, and distillation with MgO. The results are shown in table II.

Only a very small amount of ammonia was produced in those cultures which were used as checks. The average amount of ammonia formed in the soil cultures receiving dried blood alone was approximately equal to that produced in the cultures receiving both dried blood and Soilvita. This study shows quite definitely that Soilvita does not increase the ammonification going on in Carrington loam. There certainly was no large addition of vigor-

ous ammonifying organisms when the culture was added to the soil.

The results of the studies of ammonification in both the peptone solution and in soil, therefore, agree exceptionally well in proving that while Soilvita contains some ammonifying organisms it does not have a large content of vigorous forms and the addition does not increase the ammonifying power of a normal soil.

Table II — Comparative Effect of Carrington Loam and Soilvita on the Ammonification of Dried Blood in Soil

LAB. No.	TREATMENT	MGS. NITROGEN IN 100 GRAMS DRY SOIL	AVERAGE NITROGEN MGS.
1	Carrington loam — 100 gms. check	0.9	
2	Carrington loam — 100 gms. check	0.7	1.5
3	Carrington loam — 100 gms. check	2.9	
4	Carrington loam — 100 gms. + 1 gm. dried blood	30.9	
5	Carrington loam — 100 gms. + 1 gm. dried blood	29.9	30.4
6	Carrington loam — 100 gms. + 1 gm. dried blood	30.4	
7	Carrington loam — 100 gms. + 1 gm. dried blood + 5 c. c. Soilvita	30.8	
8	Carrington loam — 100 gms. + 1 gm. dried blood + 5 c. c. Soilvita	30.8	30.7
9	Carrington loam — 100 gms. + 1 gm. dried blood + 5 c. c. Soilvita	30.6	

Nitrification — In order to study the effect of Soilvita on nitrification and hence to secure data on the number and efficiency of the nitrifying organisms present in the material the following test was carried out.

Eighteen portions of 116.2 gms. of fresh Carrington loam (this amount being equivalent to 100 grams of moisture-free soil) were weighed into glass tumblers. Treatments were made in triplicate as follows:

1, 2, 3 — Check (nothing added)
4, 5, 6 — 30 mgs. N as $(NH_4)_2SO_4$
7, 8, 9 — 30 mgs. N as $(NH_4)_2SO_4$ + 210 mgs. $CaCO_3$
10, 11, 12 — Soilvita — 5 c. c.
13, 14, 15 — Soilvita — 5 c. c. + 30 mgs. N as $(NH_4)_2SO_4$
16, 17, 18 — Soilvita — 5 c. c. + 30 mgs. N as $(NH_4)_2SO_4$ + 210 mgs. $CaCO_3$

The moisture content in the soils was adjusted to the optimum and the soils were incubated at room temperature for four weeks. Nitrates were then determined by the phenoldisulphonic acid method. The results are shown in table III.

An average of 2.68 mgs. of nitrate nitrogen was present in the

check soils after incubating four weeks. Soilvita had practically no effect in nitrifying the soils' own nitrogen as only 3.31 mgs. of nitrogen were produced in the soils treated with Soilvita. If the one high determination of 4.10 mgs. with the Soilvita treatment and the one low determination of 2.16 mgs. of nitrogen for the check soil are omitted from the averages, the amount of nitrate nitrogen formed would be the same for the check and the Soilvita treatment.

Table III — Comparative Effect of Carrington Loam and Soilvita on Nitrification

Lab. No.	Treatment	Nitrates Mg. N Per 100 Gms. Soil	Average
1	Check (nothing added)	3.15	
2	Check	2.73	2.68
3	Check	2.16	
4	$(NH_4)_2SO_4$ (30 mgs.)	7.58	
5	$(NH_4)_2SO_4$ (30 mgs.)	7.87	7.13
6	$(NH_4)_2SO_4$ (30 mgs.)	5.94	
7	$(NH_4)_2SO_4$ (30 mgs.) + $CaCO_3$ (210 mgs.)	18.07	
8	$(NH_4)_2SO_4$ (30 mgs.) + $CaCO_3$ (210 mgs.)	20.45	20.15
9	$(NH_4)_2SO_4$ (30 mgs.) + $CaCO_3$ (210 mgs.)	21.93	
10	Soilvita (5 c. c.)	2.92	
11	Soilvita (5 c. c.)	4.10	3.31
12	Soilvita (5 c. c.)	2.92	
13	Soilvita (5 c. c.) + $(NH_4)_2SO_4$ (30 mgs.)	6.62	
14	Soilvita (5 c. c.) + $(NH_4)_2SO_4$ (30 mgs.)	7.58	7.58
15	Soilvita (5 c. c.) + $(NH_4)_2SO_4$ (30 mgs.)	8.54	
16	Soilvita (5 c. c.) + $(NH_4)_2SO_4$ (30 mgs.) + $CaCO_3$ (210 mgs.)	17.53	
17	Soilvita (5 c. c.) + $(NH_4)_2SO_4$ (30 mgs.) + $CaCO_3$ (210 mgs.)	18.07	17.89
18	Soilvita (5 c. c.) + $(NH_4)_2SO_4$ (30 mgs.) + $CaCO_3$ (210 mgs.)	18.07	

When the nitrifying power was tested by adding ammonium sulfate to the soil an average of 7.13 mgs. of nitrate nitrogen was formed and when Soilvita was added with the ammonium sulfate, the amount of nitrate found was 7.58 mgs. Here the differences among the triplicate tests were greater than between the different treatments, and hence the small gain noted for the Soilvita treatment must be considered insignificant.

The results obtained when ammonium sulfate and calcium carbonate were used compared with those secured with the ammonium sulfate, calcium carbonate and Soilvita prove quite conclusively that Soilvita has had no effect on the transformation of ammonia into nitrates according to this test.

The data obtained in these studies on nitrification considered as a whole show quite definitely that the material does not contain

any large supply of nitrifying organisms, if any, and certainly no efficient forms. Its use did not have any effect on the nitrifying power of a normal soil.

Nonsymbiotic Nitrogen Fixation — The nonsymbiotic nitrogen-fixing power of Soilvita was studied by inoculating three 100 c. c. portions of a sterile nitrogen free dextrose solution with 5 c. c. of Soilvita and incubating the cultures for 14 days. Triplicate flasks containing 100 c. c. of the sterile medium were also inoculated with 5 grams of Carrington loam, and three other flasks were inoculated with 5 grams of Carrington loam and 5 c. c. of Soilvita. This study, therefore, afforded a means of comparing the efficiency of the nitrogen-fixing organisms in Soilvita with those present in this soil. After incubation, total nitrogen determinations were made on these cultures, as well as on control cultures which had previously been prepared. The amount of nitrogen fixed was found by subtracting the nitrogen in the control cultures from that in the incubated cultures. The results of this study are given in table IV.

Where Soilvita alone was added to the solutions and incubated for 14 days, only a very small amount of nitrogen, an average of 0.32 mg., was found to be taken from the air. This amount, being so small, may be considered insignificant. When 5 grams of Carrington loam were used for the inoculum, there was a fixation of 3.84 mgs. of nitrogen per gram of dextrose. Practically the same amount, 3.88 mgs. was fixed in those cultures which had been inoculated with Soilvita and Carrington loam. These data, therefore, show that Soilvita contains no active nonsymbiotic nitrogen-fixing organisms, and consequently, its use would not be warranted as a means of increasing the nitrogen fixed nonsymbiotically in the soil.

Numbers of Microörganisms — The plate method was used for counting the total number of soil microörganisms found in Soilvita and in Carrington loam. Brown's egg albumen agar was used for the counts of bacteria and actinomycetes; Waksman's synthetic acid medium was used for the mold counts. The results are shown in table V.

Soilvita was found to be free of molds and actinomycetes. One c. c. contained only half as many bacteria as were present in 1 gm. of Carrington loam. The figure given in the table for the bacteria in the soil represents the number of organisms present in one gram of soil containing 16.0 per cent moisture. Soilvita is claimed

Table IV — Nonsymbiotic Nitrogen Fixing Power of Soilvita and Carrington Loam in Nitrogen-free Dextrose Solution

Lab. No.	Treatment	Mgs. Nitrogen Fixed Per Gram Dextrose	Average
1	100 c. c. medium + 5 c. c. Soilvita	0.28	
2	100 c. c. medium + 5 c. c. Soilvita	0.28	0.32
3	100 c. c. medium + 5 c. c. Soilvita	0.42	
4	100 c. c. medium + 5 c. c. Soilvita + 5 gms. Carrington loam	4.05	
5	100 c. c. medium + 5 c. c. Soilvita + 5 gms. Carrington loam	3.67	3.88
6	100 c. c. medium + 5 c. c. Soilvita + 5 gms. Carrington loam	3.92	
7	100 c. c. medium + 5 grams Carrington loam	3.92	
8	100 c. c. medium + 5 grams Carrington loam	3.64	3.84
9	100 c. c. medium + 5 grams Carrington loam	3.97	

Table V — Total Numbers of Microörganisms in Carrington Loam and Soilvita

Lab. No.	Treatment	Micro-organisms Per Gram Soil or Per c.c. Solution		
		Molds	Bacteria	Actinomycetes
1	Carrington loam	9,000	5,250,000	105,000
2	Soilvita	----	2,560,000	-------

to be a bacterial preparation for the inoculation of crops, and it would be expected to be very high in bacteria. One c. c., however, contained only 2,560,000 bacteria, which must be considered very low for such a product. The low count may be due to the anaerobic conditions under which the organisms must live, which would lead to a killing off of the desirable aerobic forms.

CONCLUSIONS

The data which have been presented in the ammonification, nitrifying and nitrogen fixation studies lead to the following conclusions:

1. Soilvita does not contain any large numbers of efficient ammonifying, nitrifying and nitrogen-fixing organisms and has no effect on the ammonifying, nitrifying or nitrogen-fixing power of Carrington loam.
2. No evidence is secured of a biological basis of value for the preparation.

Iowa State College,
Ames, Iowa.